## COAL DATA SOURCES

*PROVINCE OF BRITISH COLUMBIA*
*MINISTRY OF ENERGY, MINES*
*AND PETROLEUM RESOURCES*

**GEOLOGICAL SURVEY BRANCH**
COAL UNIT
(Coal quality and geology information)
553 Superior Street
Victoria, B.C. V8V 1X4 Canada
Phone: (604) 387-5975 Fax: (604) 356-8153

| | |
|---|---|
| John Cunningham | Northeast B.C. |
| Dave Grieve | Southeast B.C./Coal Quality |
| Barry Ryan | Northwest B.C./Coalbed Methane |
| Alex Matheson | Central and South Central B.C., Vancouver Island |
| Maria Holuszko | Coal Quality |

**MINERAL POLICY BRANCH**
(Policy, statistics, economics and land use)
525 Superior Street, Room 26
Victoria, B.C. V8V 1X4
Phone: (604) 387-3787 Fax: (604) 387-5713

**MINERAL TITLES BRANCH**
(Coal rights tenure)
525 Superior Street, Room 17
Victoria, B.C. V8V 1X4
Phone: (604) 387-4417 Fax: (604) 387-3594

**RESOURCE MANAGEMENT BRANCH**
(Coal exploration and production permitting and regulation; reclamation)
525 Superior Street, Room 105
Victoria, B.C. V8V 1X4
Phone: (604) 387-3781 Fax: (604)387-5985

**PETROLEUM TITLES BRANCH**
(Oil and natural gas tenure, including coalbed methane)
617 Government Street, 4th Floor
Victoria, B.C. V8V 1X4
Phone: (604) 387-1908 Fax: (604) 356-0160

*Coal quality and/or production data are also generally available from the following:*

*ENERGY, MINES AND RESOURCES CANADA*
CANMET
Coal Research Laboratories
P.O. Bag 1280
Devon, Alberta T0C 1E0

CANMET
Energy Research Laboratories
555 Booth Street
Ottawa, Ontario K1A 0G1

Geological Survey of Canada
The Institute of Sedimentary and Petroleum Geology
3303-33rd Street N.W.
Calgary, Alberta T2L 2A7

Mineral Policy Sector
460 O'Connor Street
Ottawa, Ontario K1A 0E4

*THE COAL ASSOCIATION OF CANADA*
502, 205-9th Avenue S.E.
Calgary, Alberta T2G 0R3

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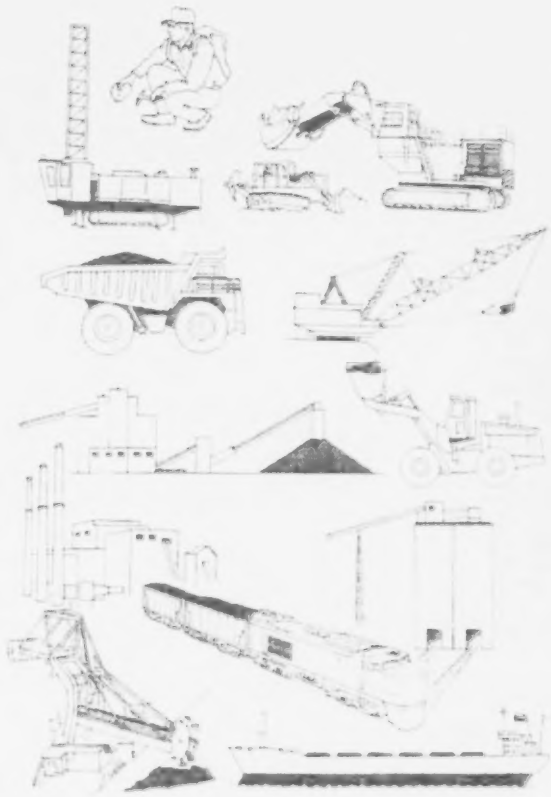
# British Columbia Coals Quality & Resources



PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENERGY, MINES AND
PETROLEUM RESOURCES
GEOLOGICAL SURVEY BRANCH

INFORMATION CIRCULAR 1992-18

## INTRODUCTION

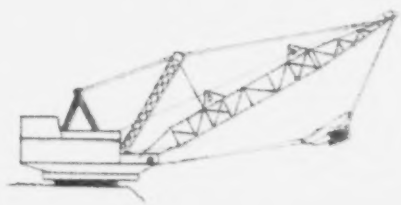
The province of British Columbia is richly endowed with more than 19 billion tonnes of coal resources which range from lignite to anthracite in rank. This brochure summarizes available information concerning the major coalfields and provides generalized coal-quality data for each. Averages of quality parameters are generally cited without reference to the range of values.

Several information sources have been used; including:

- Published reports of the British Columbia Ministry of Energy, Mines and Petroleum Resources; *CANMET*, the Geological Survey of Canada; and, the technical articles written by staff of coal mining and exploration companies.
- Unpublished, assessment reports submitted to the British Columbia Ministry of Energy, Mines and Petroleum Resources by exploration companies in compliance with the B.C. *Coal Act*.
- Trade publications, including the TEX Report's "Coal Manual".

Caution is advised in using data contained in this brochure. Quality variations within individual coalfields and/or basins are often pronounced and the values presented may not be representative of the range of coal quality present. Where product specifications are listed, these values represent the current range of market demand, rather than the full range of available coal quality.

An efficient and intricate infrastructure is in place within the province, including rail and road transportation routes, power networks, community services, deep-water seaports and communications systems. This ensures that British Columbia coal resources are among the most competitive in the world.



## PRODUCING COMPANIES

**ESSO RESOURCES CANADA LIMITED**
237 - 4th Avenue S.W.
Calgary, Alberta
T2P 0H6
Phone: (403) 237-3737
FAX: (403) 237-3037

**FORDING COAL LIMITED**
1000, 205 - 9th Avenue S.E.
Calgary, Alberta
T2G 0R4
Phone: (403) 264-1063
FAX: (403) 264-7339

**HILLSBOROUGH RESOURCES LIMITED**
c/o 1280 - 1055 West Hastings Street
Vancouver, British Columbia
V6E 2E9
Phone: (604) 684-9288
FAX: (604) 684-3178

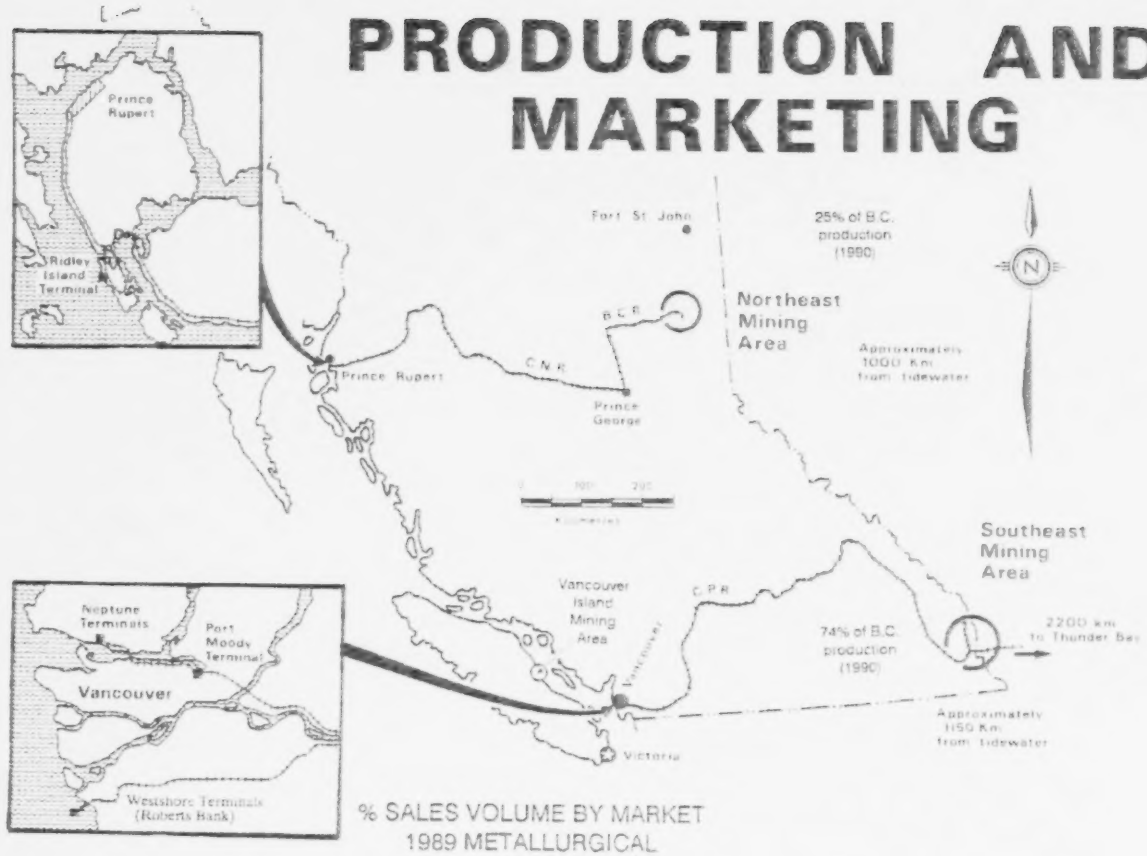
**MANALTA COAL LTD.**
734 - 7th Avenue S.W.
P.O. Box 2880
Calgary, Alberta
T2P 2M7
Phone: (403) 294-5311
FAX: (403) 269-8075

**QUINTETTE COAL LIMITED**
200 Burrard Street
Vancouver, British Columbia
V6C 3L9
Phone: (604) 687-1117
FAX: (604) 687-6100

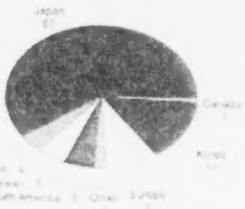
**TECK CORPORATION**
200 Burrard Street
Vancouver, British Columbia
V6C 3L9
Phone: (604) 687-1117
FAX: (604) 687-6100

**WESTAR MINING LTD.**
1176 West Georgia Street
Vancouver, British Columbia
V6E 4B8
Phone: (604) 681-8222
FAX: (604) 681-9537

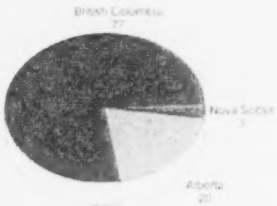
# PRODUCTION AND MARKETING




% SALES VOLUME BY MARKET
1989 METALLURGICAL
COAL SHIPMENTS*

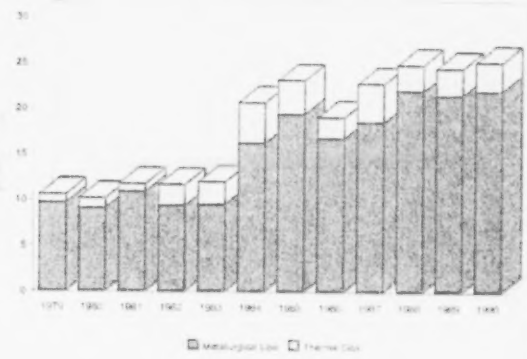



PRODUCTION OF
COKING COAL
IN CANADA, 1989*




% SALES VOLUME BY MARKET
1989 THERMAL
COAL SHIPMENTS*

PRODUCTION OF COKING AND THERMAL COAL
1979 - 1990

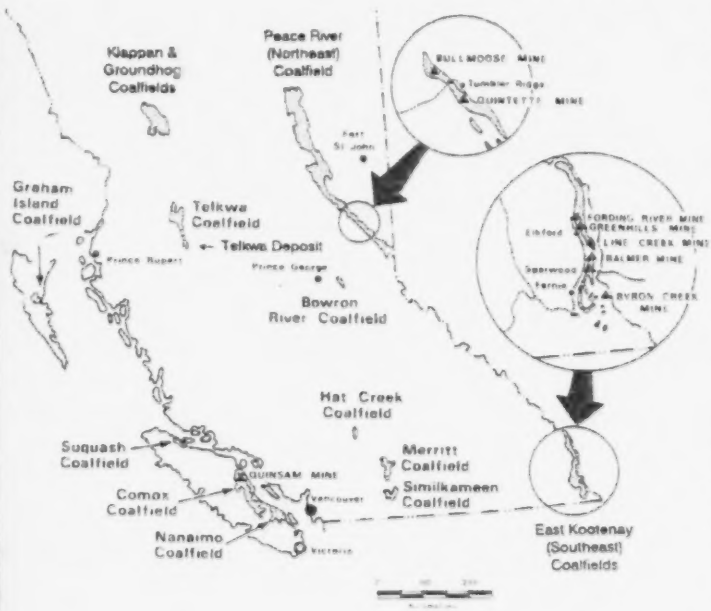


# COALFIELDS AND RESOURCES

## RESOURCES

| COALFIELD | A.S.T.M. COAL RANK | POTENTIAL UTILIZATION | MEASURED RESERVES (millions of tonnes) | TOTAL RESOURCES OF IMMEDIATE INTEREST* (millions of tonnes) |
|---|---|---|---|---|
| Peace River | Low to High Volatile Bituminous | Metallurgical and Thermal | 1015 | 9270 |
| East Kootenay | Low to High Volatile Bituminous | Metallurgical and Thermal | 1370 | 6670 |
| Klappan and Groundhog | Low Volatile Bituminous to Anthracite | Thermal | 100 | 1600 |
| Telkwa Deposit | High Volatile A Bituminous | Thermal | 30 | 180 |
| Hat Creek | Lignite to Subbituminous B | Thermal | 440 | 940 |
| Similkameen | Lignite to High Volatile B Bituminous | Thermal | 20 | 350 |
| Merritt | High Volatile B to A Bituminous | Thermal | 10 | 80 |
| Comox | High Volatile A & B Bituminous | Thermal | 35 | 265 |
| Nanaimo | High Volatile A & B Bituminous | Thermal | 0 | 10 |
| Suquash | High Volatile C & B Bituminous | Thermal | 0 | 40 |
| Bowron River | High Volatile B & C Bituminous | Thermal | 10 | 70 |
| | | TOTAL | 3030 | 19 475 |

*Source: Smith G.G. (1989): Coal Resources of Canada, Geological Survey of Canada, Paper 1989-4.*




## MINES

| OWNER | MINE | MINING METHOD | 1990 CLEAN COAL PRODUCTION* (millions of tonnes) | UTILIZATION |
|---|---|---|---|---|
| **NORTHEAST** | | | | |
| Teck Corporation | Bullmoose | Open Pit | 1.6 | Mainly Metallurgical |
| Quintette Coal Limited | Quintette | Open Pit | 4.6 | Metallurgical |
| **SOUTHEAST** | | | | |
| Fording Coal Limited | Fording River | Open Pit | 6.3 | Metallurgical and Thermal |
| Westar Mining Ltd. | Greenhills | Open Pit | 3.0 | Metallurgical and Thermal |
| | Balmer | Open Pit | 5.6 | Metallurgical and Thermal |
| Manalta Coal Ltd. | Line Creek | Open Pit | 2.1 | Metallurgical and Thermal |
| Esso Resources Canada Limited | Byron Creek | Open Pit | 1.5 | Thermal and Weak Coking |
| **VANCOUVER ISLAND** | | | | |
| Hillsborough Resources Limited | Quinsam | Open Pit and Underground | 0.3 | Thermal |
| | | TOTAL | 25.0 | |

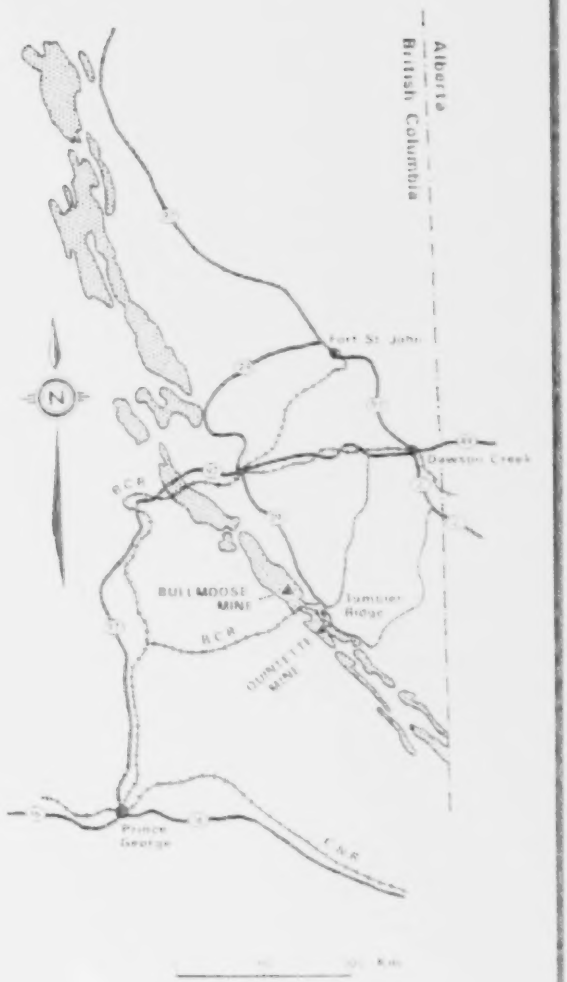
*From the Coal Association of Canada, 1991 directory.*

# NORTHEAST

| | |
|---|---|
| AGE | Early Cretaceous |
| TOTAL RESOURCES OF IMMEDIATE INTEREST | 9270 million tonnes |
| MEASURED RESERVES | 1015 million tonnes |

| | 'RUN-OF-MINE' COAL | METALLURGICAL PRODUCTS* | THERMAL PRODUCTS* |
|---|---|---|---|
| PROXIMATE ANALYSIS, % | | | |
| (as received) | | air dried | air dried |
| Moisture | 5.0 | 1.0-2.0 | 2.0-2.5 |
| Ash | 15.0 (14.5-21.5) | 9.5 | 10.0 |
| Volatile Matter | 22.5 | 20-26 | 21-23 |
| Fixed Carbon | 57.5 | 63-69 | 60.0-66.5 |
| SULPHUR, % | 0.5 | 0.5 | 0.5 |
| HEATING VALUE | | | |
| MJ/kg | 29.1 | 30.2 | 29.3-31.4 |
| BTU/lb | 12 500 | 13 000 | 12 600-13 500 |
| kcal/kg | 7 000 | 7 222 | 7000-7500 |
| A.S.T.M. RANK | | High to Low Volatile Bituminous | |
| ULTIMATE ANALYSIS, % | | | |
| (dry, ash-free basis) | | | |
| Carbon | 86.0 | | |
| Hydrogen | 5.0 | | |
| Oxygen | 5.4 | | |
| Nitrogen | 1.4 | | |
| Sulphur | 0.2 | | |
| | 100.0 | | |
| HARDGROVE GRINDABILITY INDEX | 72-82 | | |
| ASH CHEMISTRY, % | | | |
| $Na_2O$ | <2.3 | | |
| $K_2O$ | <2.7 | | |
| $P_2O_5$ | <1.6 | | |
| INITAL DEFORMATION TEMPERATURE °C | 1200-1300, oxidizing | | |
| FREE SWELLING INDEX | 1-7 | 5-7 | |
| $\bar{R}_o$max | 1.2 (0.8-1.7) | | |
| FLUIDITY, d.d.p.m. | | 90 | |
| SIZE, mm | | 38 x 0, 50 x 0 | |
| SULPHUR FORMS, % | | | |
| Pyritic | <0.2 | | |
| Sulphate | 0.0 | | |
| Organic | <0.4 | | |
| | <0.6 | | |

*Ranges derived from the 1988 TLX Report Coal Manual. These ranges represent current contract specifications with Japanese importers - they do not represent the limits of quality specifications of northeast B.C. coals.*



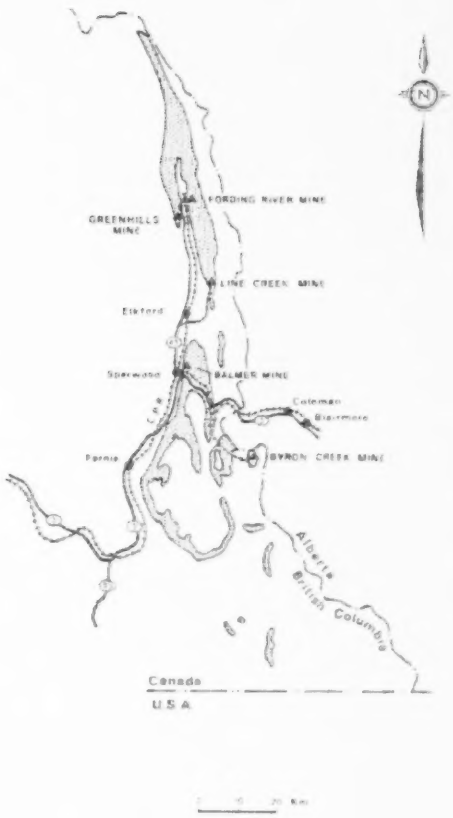
# SOUTHEAST

AGE: Late Jurassic, Early Cretaceous

TOTAL RESOURCES OF IMMEDIATE INTEREST: 6670

MEASURED RESERVES: 1370

| | 'RUN-OF-MINE' COAL | METALLURGICAL PRODUCTS* | THERMAL PRODUCTS* | SEMI-COKING PRODUCTS* |
|---|---|---|---|---|
| PROXIMATE ANALYSIS, % (air-dried basis) | | | | |
| Moisture | 2.0 | 1.0-1.5 | 1.0-1.5 | |
| Ash | 17.0 | 6.5-9.5 | 9-15 | 8.5-10.5 |
| Volatile Matter | 23.0 | 19-33 | 19.5-31 | 21-28 |
| Fixed Carbon | 58.0 | 59-69 | 60-66 | |
| | 100.0 | | | |
| SULPHUR, % | 0.4 | 0.4-0.5 max | 0.3-0.6 | 0.3-0.6 |
| HEATING VALUE | | | | |
| BTU/lb | 12 250 | 13 680-14 040 | 11 520-13 320 | |
| MJ/kg | 28.5 | 31.3-32.7 | 26.8-31.0 | |
| kcal/kg | 6820 | 7600-7800 | 6400-7400 | |
| A.S.T.M. RANK | Low to High Volatile Bituminous | | | |
| ULTIMATE ANALYSIS, % (dry, ash-free basis) | | | | |
| Carbon | 87.5 | | | |
| Hydrogen | 5.0 | | | |
| Oxygen | 5.5 | | | |
| Nitrogen | 1.6 | | | |
| Sulphur | 0.4 | | | |
| | 100.0 | | | |
| HARDGROVE GRINDABILITY INDEX | 84 (65- > 100) | | | |
| ASH CHEMISTRY, % | | | | |
| $Na_2O$ | 0.1 | | | |
| $K_2O$ | 1.0 | | | |
| $P_2O_5$ | 1.3 | | | |
| INITIAL DEFORMATION TEMPERATURE °C | 1450 (1250-1482+) oxidizing | | | |
| FREE SWELLING INDEX | 4.0 (2-7.5) | 6-8 | 1.5-5 | 3-6 |
| $\bar{R}_r$max+ | 1.3 (0.8-1.6) | | | |
| FLUIDITY, d.d.p.m. | < 100 | | | |
| SIZE, mm | | 38 x 0 | | |
| SULPHUR FORMS, % | | | | |
| Pyritic | 0.1 | | | |
| Sulphate | 0.0 | | | |
| Organic | 0.3 | | | |
| | 0.4 | | | |




* *Ranges derived from the 1988 TEX Report Coal Manual. These ranges represent current contract specifications with Japanese importers - they do not represent the limits of quality specifications of southeast B.C. coals.*

+ *Source: B.C. Geological Survey.*

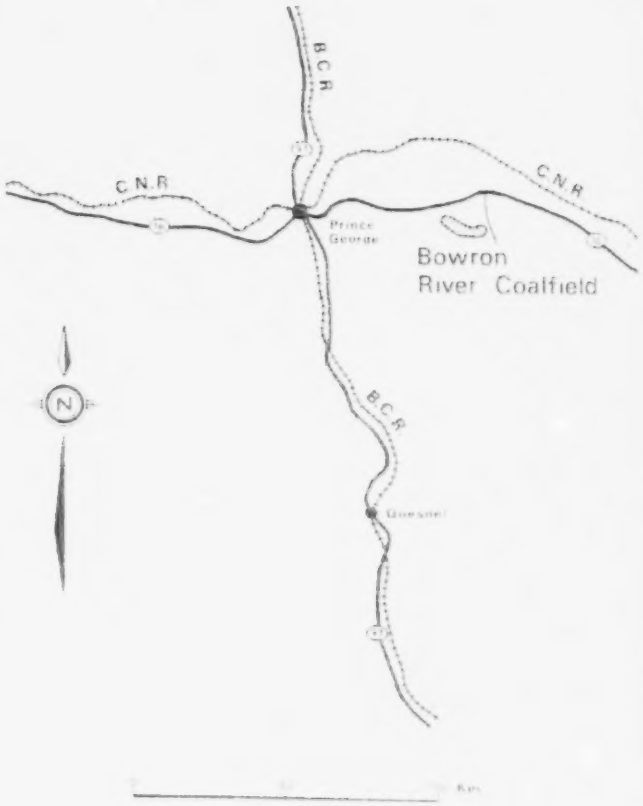
# NORTHWEST

| | TELKWA | KLAPPAN and GROUNDHOG | | TUYA RIVER |
|---|---|---|---|---|
| AGE | Early Cretaceous | Late Jurassic | | Early Tertiary |
| UTILIZATION | Thermal | Thermal | | Thermal |
| TOTAL RESOURCES OF IMMEDIATE INTEREST | 180 million tonnes | 1600 million tonnes | | - |
| MEASURED RESERVES | 30 million tonnes | 100 million tonnes | | - |
| PROXIMATE ANALYSIS, % (as received) | | | Beneficiated | |
| Moisture | 4.0 | 2.0 | 1.0 | 11.1 |
| Ash | 21.0 | 36.0 | 6.0 | 24.3 |
| Volatile Matter | 25.5 | 8.0 | 6.5 | 29.1 |
| Fixed Carbon | 49.5 | 54.0 | 86.5 | 34.3 |
| | 100.0 | 100.0 | 100.0 | 98.8 |
| SULPHUR, % | 1.8 | 0.5 | 0.5 | 0.5 |
| HEATING VALUE | | | | |
| MJ/kg | 25.5 | 20.5 | 32.4 | 18.3 |
| BTU/lb | 10 950 | 8 800 | 13 950 | 7 880 |
| kcal/kg | 6 080 | 4 890 | 7 750 | 4 360 |
| A.S.T.M. RANK | High Volatile A Bituminous | Low Volatile Bituminous to Anthracite | | High Volatile C to B Bituminous |
| ULTIMATE ANALYSIS, % (dry, ash-free basis) | | | | |
| Carbon | 80.0 | 90.2 | | |
| Hydrogen | 5.0 | 3.0 | | |
| Oxygen | 13.0 | 5.0 | | |
| Nitrogen | 0.8 | 1.0 | | |
| Sulphur | 1.2 | 0.8 | | |
| | 100.0 | 100.0 | | |
| HARDGROVE GRINDABILITY INDEX | 60 | 48 | | 53 |
| ASH CHEMISTRY, % | | | | |
| $Na_2O$ | 0.8 | 1.0 | | |
| $K_2O$ | 0.3 | 1.0 | | |
| $P_2O_5$ | 0.6 | 1.0 | | |
| INITIAL DEFORMATION TEMPERATURE °C | 1450 | 1250 | | |
| FREE SWELLING INDEX | Up to 5.5 | | | |
| $\bar{R}_o$max | 0.87* | 3.2 to 3.8+ | | 0.73* |

*Source: B.C. Geological Survey*
+ *Source: Gulf Canada*

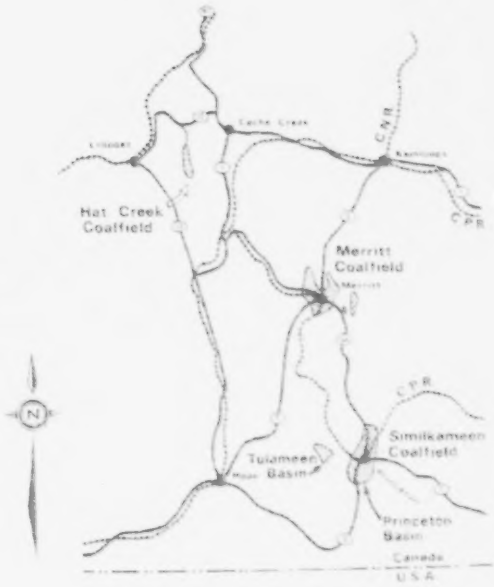
# CENTRAL

| | | |
|---|---|---|
| AGE | | Tertiary |
| TOTAL RESOURCES OF IMMEDIATE INTEREST | | 70 million tonnes |
| MEASURED RESERVES | | 10 million tonnes |
| UTILIZATION | | Thermal |
| PROXIMATE ANALYSIS, % (as received basis) | | |
| Moisture | | 4.0 |
| Ash | | 35.7 |
| Volatile Matter | | 26.4 |
| Fixed Carbon | | 33.9 |
| | Total | 100.0 |
| SULPHUR, % | | 1.25 |
| HEATING VALUE (as received) | | |
| MJ/kg | | 18.6 |
| BTU/lb | | 8 000 |
| kcal/kg | | 4 500 |
| A.S.T.M. Rank | | High Volatile C and B Bituminous |
| ULTIMATE ANALYSIS, % (dry, ash-free basis) | | |
| Carbon | | 75.8 |
| Hydrogen | | 5.8 |
| Oxygen | | 15.2 |
| Nitrogen | | 1.6 |
| Sulphur | | 1.6 |
| | Total | 100.0 |
| HARDGROVE GRINDABILITY INDEX | | 53 |
| PETROGRAPHY | | $\bar{R}_o max$ = 0.65<br>0-2% Resinite |



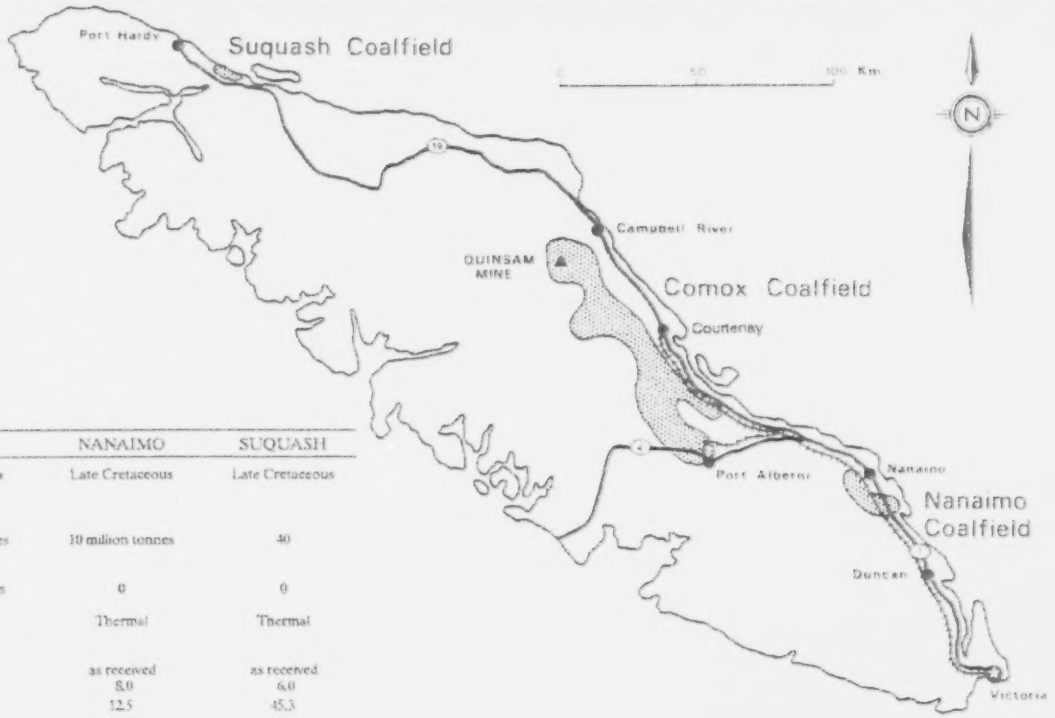
# SOUTH CENTRAL

| | HAT CREEK | MERRITT | SIMILKAMEEN | |
|---|---|---|---|---|
| | | | Tulameen Basin | Princeton Basin* |
| AGE | Tertiary Eocene | Tertiary Eocene | Tertiary Eocene | |
| TOTAL RESOURCES OF IMMEDIATE INTEREST | 940 million tonnes | 89 million tonnes | 240 million tonnes | 110 million tonnes |
| MEASURED RESERVES | 440 million tonnes | 10 million tonnes | 20 million tonnes | 0 |
| UTILIZATION | Thermal | Thermal | Thermal | |
| PROXIMATE ANALYSIS, % (as received) | | | | |
| Moisture | 23.5 | 5.0 | 5.5 | 16.2 |
| Ash | 26.6 | 9.0 | 8.8 | 7.0 |
| Volatile Matter | 24.8 | 34.0 | 29.0 | 30.8 |
| Fixed Carbon | 25.1 | 52.0 | 56.7 | 46.2 |
| | 100.0 | 100.0 | 100.0 | 100.2 |
| SULPHUR, % | 0.4 | 0.6 | 0.6 | 0.45 |
| HEATING VALUE (as received) | | | | |
| MJ/kg | 13.5 | 29.1 | 27.2 | 23.5 |
| BTU/lb | 5800 | 12 500 | 11 700 | 10 100 |
| kcal/kg | 3 200 | 6 950 | 6 500 | 5 600 |
| A.S.T.M. RANK | Lignite to Subbituminous B | High Volatile B to A Bituminous | High Volatile C to B Bituminous | Lignite to High Volatile B Bituminous |
| ULTIMATE ANALYSIS, % | | | | |
| (dry, ash-free basis) | 72.9 | | | |
| Hydrogen | 4.8 | | | |
| Oxygen | 20.3 | | | |
| Nitrogen | 1.5 | | | |
| Sulphur | 0.5 | | | |
| HARDGROVE GRINDABILITY INDEX | | 57 | 51 | |
| ASH CHEMISTRY, % | | | | |
| $Na_2O$ | 1 | | 0.67 | |
| $K_2O$ | 0.5 | | 0.64 | |
| $P_2O_5$ | 0.2 | | 0.17 | |
| INITIAL DEFORMATION TEMPERATURE °C | 1400-1500 ash fusion oxidizing atm. | 1550 softening | 1400 oxidizing atm. | |
| $\bar{R}_o$max.* | 0.4 | 0.75 | .57-.70 | |




*"Princeton" seam only Mine data.

* Source: B.C. Geological Survey




# VANCOUVER ISLAND

| | COMOX* | NANAIMO | SUQUASH |
|---|---|---|---|
| AGE | Late Cretaceous | Late Cretaceous | Late Cretaceous |
| TOTAL RESOURCES OF IMMEDIATE INTEREST | 265 million tonnes | 10 million tonnes | 40 |
| MEASURED RESERVES | 35 million tonnes | 0 | 0 |
| UTILIZATION | Thermal | Thermal | Thermal |
| PROXIMATE ANALYSIS, % | air-dried | as received | as received |
| Moisture | 3.5 | 8.0 | 6.0 |
| Ash | < 13.5 | 12.5 | 45.3 |
| Volatile Matter | 48.0 | 35.7 | 23.3 |
| Fixed Carbon | 36.5 | 43.8 | 25.4 |
| | | 100.0 | 100.0 |
| SULPHUR, % | 0.6 | 0.6 | 2.2 |
| HEATING VALUE | | | |
| MJ/kg | 27.2 | 27.0 | 13.9 |
| BTU/lb | 11 700 | 11 600 | 5 969 |
| kcal/kg | 6 500 | 6 450 | 3 316 |
| A.S.T.M. RANK | High Volatile A+B Bituminous | High Volatile A+B Bituminous | High Volatile C+B Bituminous |
| ULTIMATE ANALYSIS, % (dry, ash-free basis) | | | |
| Carbon | 80.9 | 82.0 | |
| Hydrogen | 5.3 | 6.1 | |
| Oxygen | 12.1 | 9.6 | |
| Nitrogen | 1.0 | 1.6 | |
| Sulphur | 0.7 | 0.7 | |
| | 100.0 | 100.0 | |
| HARDGROVE GRINDABILITY INDEX | 45 minimum | 53-85 | 43 |
| ASH CHEMISTRY, % | | | |
| $Na_2O$ | 0.2 | 0.5 | |
| $K_2O$ | 0.2 | 0.9 | |
| $P_2O_5$ | 0.7 | 0.4 | |
| INITIAL DEFORMATION TEMPERATURE °C | > 1275 oxidizing atm. | 1280 oxidizing atm. | |
| FREE SWELLING INDEX | 1.5 to 2.5 | up to 4.5 | 1.5 |
| $\bar{R}_o$max* | 0.6-0.85 | 0.64-0.72 | 0.63-0.81 |

* *Product specifications, Quinsam mine, 1988.*
† *Source: B.C. Geological Survey Branch.*